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RESEARCH REPORT

Relationship between self-efficacy, beliefs, and physical activity in inflammatory arthritis



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KEYWORDS

beliefs;
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Abstract *Background:* The benefits of physical activity (PA) in inflammatory arthritis (IA) patients are well-established. However, levels of PA in the IA population are suboptimal and the psychological determinants of PA are poorly understood.

Objective: The study aimed to examine the self-reported PA levels and psychological determinants of PA for the IA population.

Methods: A cross-sectional study of people with rheumatoid arthritis (RA) and psoriatic arthritis (PsA) was conducted to explore the association between demographic and psychological variables such as self-efficacy and belief about PA, and levels of PA and energy expenditure (EE). PA was recorded using the Yale Physical Activity Survey (YPAS).

Results: A total of 102 participants were included in the study. Participants reported low levels of PA [mean \pm standard deviation (SD), 24.3 \pm 18.2]. Beliefs about PA, but not self-efficacy, correlated with levels of self-report PA over the past week ($r = 0.25$, $p = 0.01$), over the past month ($r = 0.21$, $p = 0.04$), and EE ($r = 0.31$, $p = 0.01$).

Conclusion: People with IA have decreased levels of PA. Beliefs about PA are associated with levels of self-report PA and EE in this population. These data provide a useful signpost for guiding and designing interventions to improve PA levels in IA populations by altering beliefs about PA. Copyright © 2016, Hong Kong Physiotherapy Association. Published by Elsevier (Singapore) Pte Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

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Introduction

Cardiovascular disease is the leading cause of death worldwide [1]. An increased risk of cardiovascular disease has been reported in both the rheumatoid arthritis (RA) and psoriatic arthritis (PsA) populations, with elevated inflammatory cytokines (C-reactive protein, interleukin-6) likely to be the underlying mechanisms [2]. Physical activity (PA) has been shown to contribute to decreasing this risk in a variety of ways, most notably by decreasing expression of these proinflammatory cytokines [3]. In fact, some have argued that due to the extensive evidence for the increased rate of cardiovascular disease in people with inflammatory arthritis (IA), increasing PA amongst people with RA and PsA should be a primary aim for health care professionals [4].

Aside from decreased cardiovascular risk, the benefits of PA reported in the current literature include improved aerobic fitness, increased muscle strength, and improved disease-related characteristics, including pain and stiffness, in the RA population [3,5]. This can lead to an improvement in ability to perform activities of daily life and also in health-related quality of life [5]. Despite these important benefits, decreased levels of PA have been reported for the RA population [6–9], with no published data available for the levels of PA for individuals with PsA.

PA levels are influenced by an extensive number of determinants in the healthy adult population, including sociodemographics, such as age, gender, and socioeconomic, as well as psychological and social factors, including self-efficacy, and social support [10]. Younger age, male gender, and social support consistently correlate with higher levels of PA in the healthy adult population, with self-efficacy and perceived health status being the main psychological variables consistently reported to correlate with PA in the same population [10,11]. The determinants of PA in the RA population are less established with no specific determinants yet identified, with further research being required to determine the health-related and psychological determinants of PA in this population [12].

Psychological factors, such as self-efficacy and beliefs about PA, have been consistently shown to influence PA levels in other populations. The concept of self-efficacy refers to people's judgements of their capabilities to organise and execute courses of action required to attain designated types of performances [13]. For example, people who are more confident in their ability to exercise and be more active and believe that they can do it tend to be more active in general [10,14]. In addition, the concept of perceived behavioural control has been postulated to influence behaviour [15]; however, it has been acknowledged that there may be some overlap in the concepts of self-efficacy and perceived behavioural control [16]. Crombie et al [14] demonstrated that PA levels in older adults were influenced more by beliefs about PA than factors such as gender and age. Studies which have explored barriers to PA in the RA population have also found that beliefs about PA, including fear, worry, and perceived negative outcomes such as pain and joint damage, are commonly cited reasons for not participating in regular PA [17,18]. Similarly subjective health status, i.e., the belief that you are in good health, rather than actual health status, was also found to be a

stronger predictor of PA [19]. Interestingly, self-rated health has also been found to be a reliable predictor of morbidity and functional limitations in other populations [20,21], implying that how one perceives their health may be an important determinant to explore, given the disease status of IA populations. Given the influence of self-efficacy and beliefs about PA on PA levels in other populations [10,14,19], the next logical step is to investigate the influence of these factors on PA in both the RA and PsA populations. More importantly, these factors, unlike age and gender, are amenable to intervention and provide a viable and practical point for health care professionals to alter behaviour [22,23]. Thus, the aim of this study was to determine if self-efficacy, self-rated health, and beliefs about PA were associated with PA in the RA and PsA populations.

Materials and methods

The study was a cross-sectional survey, using self-report questionnaires.

Recruitment

Potential participants were recruited from two rheumatology outpatient clinics, one urban and one rural, in the mid-western region of Ireland. Participants were English-speaking adults, aged >18 years, with a clinical diagnosis of RA, as per the American College of Rheumatology/European League against Rheumatism [24] criteria, or PsA, as per the Classification Criteria for Psoriatic Arthritis criteria [25], and without any type of cognitive impairment, e.g., dementia. Cognitive impairment was determined from the medical records of potential participants. Patients attending rheumatology outpatient clinics in the Health Service Executive (HSE) Mid-Western University Hospitals were approached by the primary investigator and a research assistant, informed about the study, and provided with a study information leaflet. Participants who agreed to participate signed a consent form to confirm their voluntary participation. Verification of the diagnosis of RA or PsA was made by checking patients' medical records. Recruitment was undertaken over a 7 week timeframe. The decision to include people with both RA and PsA was taken to determine if variations existed between IA type and self-report PA levels and also to create a self-report PA profile of people with PsA, as no literature exists for this patient group. One hundred and forty-seven participants were eligible for inclusion in the study.

Ethics approval

Ethics approval was received from the HSE Mid-Western Regional Hospital Research Ethics Committee (Limerick, Ireland) for the study.

Sociodemographic information

A customised questionnaire was designed to collect sociodemographic information, including age, sex, IA diagnosis,

disease duration, living status, occupational status, and medications.

Physical activity

The measurement of PA is a controversial issue, with evidence demonstrating positive and negative aspects of both subjective and objective methods of measurement [26]. Validated measurement methods of PA and energy expenditure (EE) in the RA population include the objective measures of the GT1M ActiGraph accelerometer, the SenseWear Armband [27] and the Yale Physical Activity Survey (YPAS) [28], which is a self-report questionnaire. The YPAS was chosen for this study as it allowed for exploration of types and intensity of PA completed by participants. The YPAS consists of two sections, measuring PA over a time period of a typical recent week (Part 1) and over the past month (Part 2). Part one assesses the amount of PA that is conducted through housework, yardwork, caregiving duties, exercise, and recreational activities. Two scores can be calculated from Part 1; the total time index (TTI), which is the amount of PA time (in hours) conducted over the past week, and the EE index (EEI) [kilocalorie (kcal)/wk], which is the amount of EE expended over the past week. Part 2 consists of five indexes: the vigorous activity index, walking activity index, moving activity index, standing activity index, and sitting activity index. The five indexes are summed to provide an Activity Dimensions Summary Index (ADSI) score, which represents the amount of PA completed by the participant over the past month, where higher scores reflect higher levels of PA. The TTI, EEI, and ADSI scores served as the dependent variables in this study.

Psychological factors

Self-efficacy

As there is currently no validated PA-specific measure of self-efficacy for the IA population, self-efficacy was measured using the Rheumatoid Arthritis Self-Efficacy (RASE) questionnaire [29]. The RASE measures task specific self-efficacy for the initiation of self-management-related behaviour, and was carefully worded to explore beliefs about capability to perform the behaviour, rather than actual ability, performance, or outcome expectation [30]. The RASE has 28 items, with five response options (strongly disagree to strongly agree). Examples of the items included in the RASE are "I believe I could do exercises to deal with the difficulties of doing everyday tasks" and "I believe I could use regular exercise". These items are scored 1–5, giving a total RASE range of 28–140. Extensive psychometric evaluation has been conducted, and the RASE has good reliability, validity, and sensitivity to change [29–31]. The internal consistency of the RASE in this study was Cronbach $\alpha = 0.84$.

Beliefs about physical activity

Activity beliefs about PA were examined using the Cognitive Response Questionnaire, which is a recently developed outcome measure for the RA population [32]. The Cognitive Response Questionnaire consists of 12 items, with responses

scored from 0 to 3, where 0 indicates the response that the statement "does not describe me at all" and 3 indicates that the statement "describes me exactly". Examples of the statements include "In my experience, my arthritis flares are under better control when I am physically active" and "In my experience, I can manage pain better when I am more physically active". Summative scores ranged from 0 to 36; higher values represent more positive beliefs about engaging in PA. In the developer's RA sample, the score had a Cronbach α of 0.89 [32] and was also found to have good internal consistency in this study (Cronbach $\alpha = 0.84$).

Health perception

Two questions were included to assess both perceived mental and physical health, as self-rated health has been found to be a reliable predictor of morbidity and functional limitations [20,21]. These were, "Compared to others your age and sex, your current mental health is excellent?" rated on a 7-point Likert scale from 1 (strongly disagree), to 7 (strongly agree). A similar item was asked for perceived physical health.

Statistical analyses

All data were entered into SPSS version 19 (SPSS Inc., Chicago, IL, USA). Data quality checks were conducted to ensure accuracy of the entered data. Data were analysed using SPSS 19 (SPSS Inc.). Data were assessed for normal distribution, using both the Kolmogorov-Smirnov and Shapiro-Wilk tests of normality. Normality of distribution was confirmed by both the interpretation of the p values and also through the visual assessment of graphs for any outliers. Correlational analysis consisted of conducting two-tailed Pearson/Spearman correlational tests. To adjust for potential confounds, hierarchical linear regressions were conducted. In the first step, potential confounds were entered, with the main predictor of interest being entered at Step 2. In cases, where variables were interrelated, tests of mediation were performed using the Baron and Kenny [33] approach. Sobel's [34] test was conducted, where appropriate, to test whether a mediator variable carried the influence of an independent variable to a dependent variable. The criteria for mediation are (1) that the criterion variable is associated with both the predictor variable and the mediator and (2) that both the predictor and mediator are related. Bootstrapping was not conducted. Missing data was managed by listwise deletion.

With regard to sample size in multiple regression analysis, varying guidelines exist for the appropriate sample size to allow for generalisability of results [35]. Tabachnick and Fidell [36] advocate a formula for calculating an appropriate sample size:

$$N > 50 + 8m, \quad (1)$$

where m is equal to the number of independent variables. In both of our regression analyses, two independent variables were tested, requiring a sample size of ≥ 66 [$50 + 8(2) = 50 + 16 = 66$]. As our sample size for the independent variables was ≥ 96 , it can be assumed that the regression analysis results can be generalised.

Results

Participant characteristics

One hundred and two participants agreed to participate. Reasons for noninclusion included refusal to participate, a language barrier, or medical conditions, e.g., dementia. Those who declined to participate in the study cited lack of time as the primary reason for nonparticipation. Complete data were available for 91 participants, with a mean \pm standard deviation (SD) age of 59.6 ± 13.2 years. As shown in Table 1, the majority of participants ($n = 79$) had a diagnosis of RA, thus the results may be more applicable to the RA population. Given the small number of participants with PsA ($n = 12$), between group analysis was not conducted. Thus, both samples were pooled and treated as one homogenous group to increase power.

Physical activity and energy expenditure levels

The mean hours of PA over the past week reported for all participants was 24.3 ± 18.2 . When the frequency of PA over the past week (TTI) based on diagnosis, i.e., RA or PsA, was examined, people with PsA reported a mean TTI score of 16.6 ± 13.0 and people with RA reported a mean TTI score of 24.7 ± 18.3 . By contrast, the ADSI scores for PA over the past month differed; people with RA reported a mean score of 43.8 ± 30.4 and people with PsA reported a

mean score of 48.7 ± 17.8 . The mean EEI score was 8730 ± 7010 kcal over the past week. The mean EEI for RA was 8690 ± 7190 kcal and the mean for participants with PsA was 6910 ± 5570 kcal). Only 22% of people with RA and 17% of people with PsA met the recommendations for daily PA of 30 minutes moderate intensity activity (leisurely walking ADSI) on 5 days of the week.

Self-efficacy and beliefs about physical activity

The mean self-efficacy for the pooled sample was 98.6 ± 17.7 . Participants with RA ($n = 77$) reported a mean self-efficacy score of 97.7 ± 19.3 , whilst those with PsA ($n = 12$) reported a slightly higher mean self-efficacy score of 104.6 ± 9.4 . The mean score for beliefs regarding PA was 24.3 ± 6.6 . The mean score for participants with RA was 24.3 ± 7 . Participants with PsA reported a mean of 22.4 ± 3.9 .

Correlates of physical activity and energy expenditure

As can be seen in Table 2, beliefs about PA positively correlated with both TTI and ADSI scores. Those reporting higher scores, i.e., more positive beliefs about PA, were more active over both time periods and also had higher levels of EE. Perceived physical health positively correlated with TTI and EEI, such that participants who reported their

Table 1 Characteristics of study participants.

Sociodemographic ^a	All ($n = 91$)	RA ($n = 79$)	PsA ($n = 12$)	Range
Age ^b (y)	60 ± 13	62 ± 12	44 ± 11	19–88
Sex (n , %)				
Female	69 (70)	55 (71)	7 (58)	
Male	29 (32)	23 (29)	5 (42)	
Diagnosis (n , %)				
Rheumatoid arthritis	79 (80)			
Psoriatic arthritis	12 (12)			
Disease duration (y)	12 ± 10	13 ± 11	13 ± 9	1–40
Marital status (n , %)				
Single	17 (17)	14 (18)	3 (25)	
Married	64 (65)	49 (62)	7 (58)	
Cohabiting	1 (1)	1 (1)	0 (0)	
Widowed	14 (14)	14 (18)	0 (0)	
Separated/divorced	3 (3)	1 (1)	2 (17)	
Living status (n , %)				
Living with someone	75 (77)	57 (74)	10 (83)	
Living alone	22 (23)	20 (26)	2 (17)	
Occupational status (n , %)				
Retired	54 (55)	46 (58)	2 (17)	
Employed	21 (21)	16 (20)	4 (33)	
Self-employed	3 (3)	1 (1)	2 (17)	
Unemployed	21 (21)	16 (20)	4 (33)	

Data are presented as mean \pm standard deviation.

PsA = psoriatic arthritis; RA = rheumatoid arthritis.

^a Some participants failed to provide sociodemographic information and were excluded from analysis for the missing variables.

^b Age was the only sociodemographic variable found to correlate with physical activity (PA) [Activity Dimensions Summary Index (ADSI) score ($r = -0.025$, $p = 0.042$)].

Table 2 Correlation matrix of physical activity and energy expenditure.

Variable	1	2	3	4	5	6	7
1 PA over past wk (TTI)							
2 EE over past wk (EEI)	0.932**						
3 PA over past mo (ADSI)	0.392**	0.472**					
4 Perceived mental health	0.031	0.030	0.063				
5 Perceived physical health	0.227*	0.248*	0.142	0.393**			
6 Self-efficacy	0.076	0.064	0.058	0.039	−0.126		
7 Beliefs about PA	0.252*	0.307**	0.205*	0.240*	0.242*	0.350**	

* Correlation is significant at 0.05 level.

** Correlation is significant at 0.01 level.

ADSI = Activity Dimensions Summary Index; EE = energy expenditure; EEI = energy expenditure index; PA = physical activity; TTI = total time index.

physical health to be better were likely to be more active and to expend more energy than those who reported a poorer perception of their physical health. Perceived mental health was shown to have no significant correlation with TTI, EEI, or ADSI (see Table 2).

No statistical association was found between self-efficacy for initiation of self-management behaviour and self-report PA over the past week (TTI) or self-report PA over the past month (ADSI; see Table 2), despite the descriptive data showing that those scoring high on self-efficacy also reported higher levels of PA. Table 2 shows the key correlations from the study, with no correlation found between the dependent variables (TTI, EEI, and ADSI) and demographic variables, such as gender and marital status, or self-efficacy.

Hierarchical linear regression and mediation results

Table 2 shows the correlation between beliefs about PA and perceptions of physical health and the correlation between beliefs about PA and TTI. To determine if beliefs about PA were associated with TTI after controlling for perceptions of physical health, a hierarchical linear regression was conducted. Perceived physical health was entered at Step 1 and was significantly associated with TTI ($p = 0.017$), predicting 6% of the variance in PA during the week. Beliefs about PA were entered at Step 2, but was not statistically significant ($\beta = 0.18$, $t = 1.79$, $p = 0.07$, $\Delta R^2 = 0.03$). A similar relationship was examined for beliefs about PA, EEI, and perceived physical health. In Step 1, perceived physical health was significantly associated with EEI ($p = 0.008$) and this predicted > 7% of the variance in EE during the week. Beliefs about PA were entered at Step 2 and were responsible for an additional 5% of variance in EEI ($\beta = 0.23$, $t = 2.30$, $p = 0.02$, $\Delta R^2 = 0.05$). As all three variables were statistically interrelated, thus the possibility of mediation was considered, i.e., that the association between perception of physical health and EEI may be working via beliefs about PA.

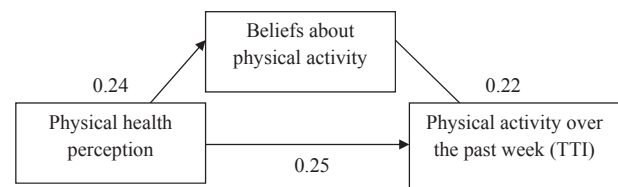
Age and beliefs about PA correlated with PA over the past month (ADSI). When age was controlled for, beliefs about PA were responsible for 5% of variance in ADSI and was statistically significant ($\beta = 0.218$, $t = 2.188$, $p = 0.031$, $\Delta R^2 = 0.05$).

Mediation analysis, as described by Baron and Kenny [33], was conducted to determine if the influence of

perception of physical health on PA over the past week/TTI was being mediated by beliefs about PA (Figure 1). Although in the expected direction, it did not achieve the standard criterion for statistical significance, $t = 1.52$, standard error = 0.087, $p = 0.12$. Mediation analysis was also conducted to determine if the influence of perception of physical health on EE over the past week/EEI was being mediated by beliefs about PA (Figure 2). The Sobel's [34] test result was $t = 1.6$, standard error = 3.5, $p = 0.11$, indicating that Sobel's [34] test is not statistically significant, i.e., that both variables seem to be predictive of EE levels over the past week (EEI) on their own, but beliefs about PA did not cancel out perceived physical health.

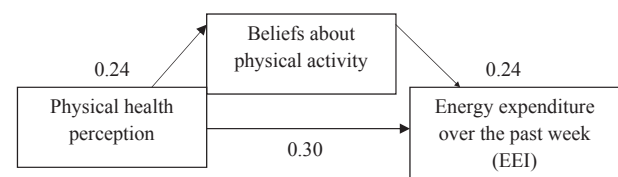
Discussion

This study aimed to explore if self-efficacy for initiation of self-management behaviour and beliefs about PA are determinants of self-report PA in the IA population. This



TTI = total time index.

Figure 1. Illustration of possible mediation relationship of beliefs about physical activity, physical health perception, and physical activity over the past week.



EEI = energy expenditure index.

Figure 2. Illustration of possible mediation relationship of beliefs about physical activity, physical health perception, and energy expenditure over the past week.

study found that people with IA have decreased levels of self-report PA and that PA levels in our study population were influenced by beliefs about PA only and not self-efficacy.

In our study, a minority of people with RA and PsA met the recommendations for daily PA of 30 minutes moderate intensity activity on 5 days of the week [37]. Our results are similar to other studies examining self-report PA in people with arthritis. Research by Sokka et al [9], who explored levels of self-report PA in RA populations across 21 countries, demonstrates that between 68% and 80% of those in the RA population are physically inactive.

Beliefs about PA have been shown to influence levels of PA in other literature, which agrees with our findings. Ehrlich-Jones et al [32] reported that as beliefs about the benefits of PA increased, PA participation also increased in the RA population. Ehrlich-Jones et al [32] also showed that higher levels of PA participation in adults with RA are related to stronger beliefs that PA can be helpful for managing disease, and leads to increased motivation to engage in PA. We did not examine specific beliefs about PA, but higher scores in the Cognitive Response Questionnaire indicate more positive beliefs about being physically active. Research has described how patients with low back pain restrict their PA because they are afraid of provoking pain [38,39]. A belief that PA will result in a worsening of symptoms has also been reported in the RA population [17,18]. Equally, when barriers to PA are examined in healthy adults, injury and illness are cited as a primary reason for not engaging in PA [40]. This appears to indicate that beliefs that PA will exacerbate the symptoms of illness or injury may limit PA levels, particularly in chronic disease populations. This is significant from a clinical perspective, as belief about PA is a factor which is amenable to change and may serve to increase PA levels in this population. Increasing PA levels is of major importance for chronic disease populations, such as IA, as PA may be of long-term benefit despite short-term exacerbations of symptoms.

The inclusion of components that focus on strengthening health beliefs and motivation to engage in PA is an important consideration in the development of interventions to promote PA participation in people with IA, given that beliefs in relation to behavioural outcomes are subject to change and beliefs that are misinformed can be challenged and the target for intervention [15]. This supports the rationale that interventions targeting beliefs about PA should lead to improved PA participation in people with RA [32]. Targeting of such beliefs has been shown to be effective in increasing levels of PA in other populations, including the healthy adult [22] and chronic disease populations [41]. Additionally, interventions targeting beliefs about PA have been successful in improving other rehabilitation outcomes, including perceived health status in the RA population [42].

Perceived health has been shown to influence PA and other health outcomes in other populations [19,43]. Our study showed that it was perceived physical health, and not perceived mental health, which influenced levels of PA in our study population. Change in perceived health has been demonstrated in other populations through PA and educational interventions [44,45] indicating that this

may be a point for inclusion in clinical practice to encourage behaviour change in the IA population. The association between PA and health perception has been investigated in the RA population previously [46,47]. Our findings are supported by the findings of Mock et al [46]. Mock et al [46] measured perceived physical and mental health by way of a 5-point Likert scale, in which participants responded to a statement about their mental or physical health, similar to the method of measurement in our study, which is positive in terms of results comparison.

Self-efficacy has been described as a component required for health-related action and behaviour change [15]. We used self-efficacy for initiation of self-management behaviour to determine the individual's perception of their ability to engage with PA, as part of their overall disease management. Interestingly, our results did not demonstrate a statistical relationship between self-efficacy and self-report PA levels in the study population, suggesting that a person's perception of their ability to engage in PA as part of their disease management does not influence their level of PA. This concurs with the findings of Neuberger et al [48], who examined the association between levels of PA in the RA population and self-efficacy. Self-efficacy is known to be a consistent determinant of PA in the healthy adult population [10,11] and has also been reported as a determinant of PA in the general arthritis [49] and RA populations [50]. This indicates that although self-efficacy is a determinant of PA in other populations, its status as a determinant of PA in the RA population is questionable. The lack of association between self-efficacy and PA in our study, however, may be attributed to the fact that the RASE measures self-efficacy for initiation of self-management behaviour and not PA-specific self-efficacy, thereby not accurately measuring the individual's perception of their ability to be physically active.

Study limitations

The primary limitation of the study was the subjective nature of the outcome measures used. Although the YPAS has been validated against an objective measure of PA in the RA population [28], the remaining outcome measures are subject to the participants' interpretation of questions. It must be noted that whilst the YPAS has been validated against an objective measure of PA, the measurement of PA, either subjectively or objectively, can result in systematic and/or individual error.

The use of a nonspecific measurement of self-efficacy is also a limitation of the study, as it measured general self-efficacy as opposed to PA-specific self-efficacy and may not have captured the participants' confidence in their ability to engage in PA. This was a challenge, as to date there are no IA/RA/PsA specific self-efficacy measures for PA/exercise alone. Additionally, none of the outcome measures used have been validated in the PsA population, which is attributable to the dearth in literature regarding PA in the PsA population. A small sample size for the PsA population did not allow for between-group analysis, as had been proposed, and limits the applicability of the study findings to this population.

Implications for future research

Interventions to increase PA levels should be developed for the IA population. These interventions should include the factors which are known to influence PA in this specific population, i.e., beliefs about PA, and should also be guided by psychology theory, as an approach such as this has proved effective in increasing PA levels in healthy populations [22].

In addition, future research on the correlates of PA, both in the RA and PsA populations, should use appropriate measurement and statistical analysis to ensure that definitive statistical relationships can be determined between relevant variables and PA. Validation of a PA-specific measure in self-efficacy in the RA and PsA populations is warranted, with validation of the YPAS and Cognitive Response Questionnaire also being of importance.

Conclusion

The primary findings of our study were that the IA population has decreased levels of PA and that beliefs about PA influence PA levels in the IA population. Beliefs about PA were shown to be a determinant of self-report PA, both in terms of PA and EE. These are important findings, particularly from the perspective of clinical practice, as a belief about PA is a variable that can be targeted and modified through educational or behaviour change interventions. This study supports the inclusion of components which address such beliefs in interventions aimed at increasing PA in the RA and PsA populations.

Conflicts of interest

The authors have no conflicts of interest to declare.

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